

# PATENT ABSTRACTS OF JAPAN

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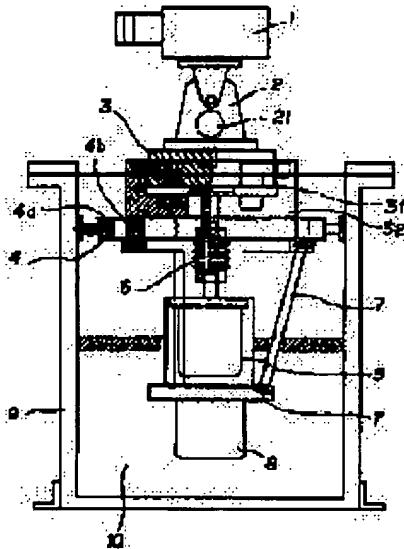
(72)Inventor : **OGURO YOSHIRO**

## (54) PAN HEAD DEVICE FOR OPTICAL EQUIPMENT

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a panhead for an optical equipment attached to a television camera, a photographic camera or a range finder which is mounted on an automobile, a marine vessel or an aircraft to monitor surrounding circumstances, so that photographing or observation is always stably performed.

**SOLUTION:** A photographing and observation equipment is displaced on a magnetically levitated rotating disk 3 with stably levitates in a direction Z and a horizontal direction by magnetic force on the inner ring 4b of a horizontal holding gimbal mechanism 4 consisting of an outer ring 4a fixed on a case 9 and pivotally attached to freely turn centering an X-axis and the inner ring 4b pivotally attached to freely turn centering the Y-axis of the outer ring 4a. A rotational angle control motor 5 is attached to the shaft of the lower surface of the disk 3, and a weight 8 is fixed at the lower end thereof, then the weight 8 is immersed in viscous liquid in the case 9.



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CLAIMS

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[Claim(s)]

[Claim 1] On the inner ring of the level maintenance gimbal mechanism which consists of an inner ring pivoted free [ rotation ] focusing on the Y-axis of the outside ring pivoted free [ rotation ] focusing on the X-axis fixed to the case, and the ring outside this, by magnetism Universal-head equipment for optical instruments characterized by having laid photography and the observation-airplane machine on the Z direction and the magnetic-levitation rotation disk which is carrying out stable surfacing horizontally, having attached the angle-of-rotation control motor in the shaft under [ this ] a magnetic-levitation rotation disk, having fixed the weight to the soffit, and \*\*\*\*(ing) this weight to the viscous liquid within a case.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] the television camera, photograph camera, or range finder which carries this invention in a run vehicle, a vessel, or the aircraft, and supervises a surrounding situation -- attaching -- always -- quantity -- it is related with the universal-head equipment for optical instruments whose stable photography or stable observation is attained

[0002]

[Description of the Prior Art] As shown in drawing 13, it equipped with the television camera 100 on the tripod 101, and the cameraman 102 operated the rolling mechanism of the upper part of a tripod 101, and the \*\*\*\*\* mechanism by manual operation, and when photoing or observing an object with a television camera from the vessel which navigates in the former, for example, Minakami, the photography direction of a television camera 100 was controlled so that an object 103 might go into the visual field of a television camera 100.

[0003]

[Problem(s) to be Solved by the Invention] if it is in the above-mentioned conventional technology, since a hull rolls, pitches and moves up and down for the billow of Minakami, ideal televising like drawing 14 obtains -- not having -- a television situation like an inclination image like drawing 15, an up cut image (the upper part shifts from a visual field.) like drawing 16, or a lower cut image like drawing 17 -- being shown -- a cameraman 102 -- each time -- the direction of a camera, and an inclination -- an amendment -- operation [ like ] had to carry out Furthermore, a shock with a hull 106 fine for a billow during a run and vertical movement are given. As it moves a television image slightly finely continuously to a sake and shows the oscillating blurring image of drawing 18 When the television camera which equipped with the telephoto lens when an object 103 like the conventional Minakami photography situation was photoed or observed especially to distant drawing 13 was used, there was a trouble that rolling, pitching, vertical movement, and a very small shock affected cameras or an optical observation-airplane machine.

[0004]

[Means for Solving the Problem] this invention aims at solving the above-mentioned trouble. On the inner ring of the level maintenance gimbal mechanism which consists of an inner ring pivoted free [ rotation ] focusing on the Y-axis of the outside ring pivoted free [ rotation ] focusing on the X-axis fixed to the case, and the ring outside this, by magnetism Photography and an observation-airplane machine are laid on a Z direction and the magnetic-levitation rotation disk which is carrying out stable surfacing horizontally, an angle-of-rotation control motor is attached in the shaft under [ this ] a magnetic-levitation rotation disk, a weight is fixed to a soffit, and it is characterized by \*\*\*\*(ing) this weight to the viscous liquid within a case.

[0005]

[Embodiments of the Invention] Hereafter, the gestalt of one example of this invention is explained in detail based on a drawing. 1 -- a camera head and 2 -- a \*\*\*\*\* adjustment base and 3 -- a magnetic-levitation rotation disk and 4 -- for a vibration isolation form rotation coupler and 7, as for a weight and 9, a weight pendant base and 8 are [ a level maintenance gimbal mechanism and 5 / an angle-of-rotation control motor and 6 / a case and 10 ] viscous liquids It equips with a camera head 1 so that the direction shaft may grow into the attachment bed of the forward-and-backward inclination angle adjustment base 2 with the \*\*\*\*\* adjustment medial axis of the \*\*\*\*\* adjustment base 2, and a right angle. The upper part of the magnetic-levitation rotation disk 3 is equipped with the \*\*\*\*\* adjustment base 2 so that a perpendicular medial axis may be in agreement with the axis of rotation of the magnetic-levitation rotation disk 3. It equips with the common perpendicular medial axis of the synthetic construct constituted with the camera head 1, the \*\*\*\*\* adjustment base 2, and the magnetic-levitation rotation disk 3 on this ring so that it may be in agreement with the inner ring 4b center of the level maintenance gimbal mechanism 4. The lower part of inner ring 4b of the level maintenance gimbal mechanism 4 is equipped with the weight pendant base 7 which equipped the inferior surface of tongue of weight pendant board 7a of the weight pendant base 7 with the weight 8.

[0006] Furthermore, after connecting the perpendicular medial axis of the magnetic-levitation rotation disk 3, and the drive axis of rotation of the angle-of-rotation control motor 5 with the upper surface of weight pendant board 7a through the vibration isolation form rotation coupler 6, it equips with the angle-of-rotation control motor 5 so that the medial axis of the magnetic-levitation rotation disk 3 and the drive axis of rotation of the angle-of-rotation control motor 5 may be in agreement. Like the above, the lower part of outside ring 4a is equipped with the lower composition mechanism which carried out connection wearing of each part article. Furthermore, 4d of external wearing axes of rotation with which outside ring 4a was equipped is attached in a case 9 with 2 sets of wearing implements which are in a ring outside the level maintenance gimbal mechanism 4.

Into a case 9, a viscous liquid 10 is poured in until the angle-of-rotation control motor 5, weight pendant board 7a, and a weight 8 are dipped into liquid. The composition of each part article and an assembly situation are as being shown in drawing 3.

[0007] Next, the magnetic-levitation rotation disk 3 is explained. The magnetic-levitation rotation disk 3 consists of a rotation disk 31 and a rotation disk plinth 32. The rotation disk 31 is equipped with a medial axis 33 at the lower center, the axial hole of the center of the rotation disk plinth 32 is penetrated, and the rotation disk 31 rotates horizontally on the rotation disk plinth 32 on the turning effort from the angle-of-rotation control motor 5 via the vibration isolation form rotation coupler 6. The center in the cylinder concave surface of the rotation disk plinth 32 upper surface is made to carry out magnetic levitation of the rotation disk 31 on the rotation disk plinth 32 in space by the magnetic rebounding force of a permanent magnet 41, a permanent magnet 42, and a permanent magnet 43. The method of making carry out magnetic levitation of the rotation disk 31 on the rotation disk plinth 32, and intercepting vibration prepares N sets of ferromagnetic permanent magnets of three kinds of sector configurations, a permanent magnet 41, a permanent magnet 42, and a permanent magnet 43, and each direction of a magnetic pole is made to magnetize so that an opposite magnetic pole may turn into a like pole, respectively and it may change with equal flux density. The quality of the material embeds [ in the bottom side of the rotation disk 31 ] a permanent magnet 41 on squares, such as 1-/N of a perimeter, at a radial into the rotation disk 31 which is a non-magnetic-material metallic conductor, and the rotation disk plinth 32. A permanent magnet 42 is embedded on squares, such as 1-/N of a perimeter, at a radial on the side inner circumference of the rotation disk plinth 32, and the base of the pillar crevice of the upper surface of the rotation disk plinth 32. And the medial axis 33 of the rotation disk 31 will surface perpendicularly in rotation disk 31 space by the rebounding force between these magnetic poles of a permanent magnet 41 and a permanent magnet 43, if the rotation disk 31 is attached in the rotation disk plinth 32 so that the medial axis of the rotation disk plinth 32 may be passed, and moreover, by the rebounding force between these magnetic poles of the permanent magnet 41 of the rotation disk 31, and a permanent magnet 42, the rotation disk 31 is held in space so that it may be horizontally located at the

[0008] Next, the level maintenance gimbal mechanism 4 is explained in detail. It consists of inside-and-outside connection axis-of-rotation 4c and 4d of 2 sets of external wearing axes of rotation of outside ring 4a and four b2 sets of inner rings. Outside ring 4a and inner ring 4b are on inside-and-outside connection axis-of-rotation 4c which is the level straight line which passes along the center of ring 4b yen inside, and equip with 2 sets of inside-and-outside connection axis-of-rotation 4c between outside ring 4a and inner ring 4b, and inner ring 4b enables it to rotate them within outside ring 4a freely focusing on inside-and-outside connection axis-of-rotation 4c so that it may become this \*\*\*\*\*, outside -- a ring -- four -- a -- \*\*\* -- outside -- a ring -- four -- a -- a yen -- a center -- a passage -- inside and outside -- connection -- the axis of rotation -- four -- c -- intersecting perpendicularly -- the exterior -- wearing -- a shaft -- a top -- it is -- outside -- a ring -- four -- a -- a periphery -- the side -- a position -- two -- a place -- two -- a set -- the exterior -- wearing -- the axis of rotation -- four -- d -- equipping -- outside A weight 8 and the weight pendant base 7 equipped with the angle-of-rotation control motor 5 are attached in the lower part of inner ring 4b, and the synthetic body constituted with the camera head 1, the \*\*\*\*\* adjustment base 2, and the magnetic-levitation rotation disk 3 is further attached in the upper part of inner ring 4b. And when all the partial mechanisms are assembled, it is made for the center-of-gravity position of AUW other than case 9 to exist sufficiently under the direction of the perpendicular lower part from the rectangular intersection of inside-and-outside connection axis-of-rotation 4c and 4d of external wearing axes of rotation. The viscous liquid 10 poured in into a case 9 pours in the amount of the viscous liquid 10 by which the angle-of-rotation control motor 5, the weight pendant base 7, and a weight 8 are enough dipped into liquid.

[0009] Next, an operation is explained. First, a level maintenance operation is explained. The level maintenance gimbal mechanism 4 is constituted by outside ring 4a, inner ring 4b, inside-and-outside connection axis-of-rotation 4c, and 4d of external wearing axes of rotation. and weight pendant board 7a by which the synthetic mechanism of the function as for which \*\*\*\*\* adjustment which the camera head 1, the \*\*\*\*\* adjustment base 2, and the magnetic-levitation rotation disk 3 constituted, and level rotation are made to the upper part of inner ring 4b was attached, and the angle-of-rotation control motor 5, the vibration isolation form rotation coupler 6, and the weight 8 were similarly attached in the lower part of inner ring 4b -- the weight pendant base 7 -- suspension installation \*\*\*\*\*

[0010] The weight of a weight 8 is chosen so that it may fully be located downward from the external wearing shaft with which the center of gravity of all the parts shown in the part block diagram of drawing 2 and the sum total weight of a mechanism is on the vertical line of the direction of the lower part from the center of the level maintenance gimbal mechanism 4, and ring 4a is equipped outside the level maintenance gimbal mechanism 4 and which is the common axis of rotation of 4d of 2 sets of external wearing axes of rotation. Thus, the level maintenance gimbal mechanism 4 in which the weight distribution was satisfied is made to hold to the wall of a case 9 by 4d of external wearing axes of rotation attached in outside ring 4a. Inner ring 4b of the level maintenance gimbal mechanism 4 can always maintain a horizontal in an operation of gravity, unless the portion of one of the mechanisms collides with the wall of a case 9, even if the case 9 which carried out sheathing inclines in the arbitrary directions. The viscous liquid 10 poured in into a case 9 has the operation which suppresses the pendulum movement phenomenon which it is going to generate when a case 9 will be shaken by external force by the flow-resistance effect of the front face of the angle-of-rotation control motor 5, the weight pendant base 7, and a weight 8, if injection rate by which the angle-of-rotation control motor 5, the weight pendant base 7, and a weight 8 are enough dipped into liquid is secured.

[0011] Next, the vibration from the body with which a case 9 is attached, and the operation (the \*\*\* effect) which does not spread a shock to a camera head 1 are explained. Like common knowledge, if it is going to bring like poles N and N, or S and S close among each magnetic pole of N and S in two permanent magnets, the force (rebounding force) mutually refused between two permanent magnets will work. moreover, the distance of 2 sets of magnets is changed into a conductor between the time

which will change if it is going to change the distance between two permanent magnets by external force when the conductor with which closed current (it is also called an eddy current) flows in the perpendicular direction of a flat surface is in the circumference of the magnetic pole of two permanent magnets which the rebounding force commits with line of magnetic force -- it is not going to make -- the closed current of a direction occurs Here, it flows in the \*\*\*\* direction in which this closed current gives reverse magnetic pole nature, and although there is a phenomenon of generating the line of magnetic force of an opposite direction in the magnetic substance, since it has a hysteresis characteristic, in the magnetic substance, an actual reverse magnetism generating phenomenon has time delay in fact. for this hysteresis effect, most is consumed as energy of closed current generating, and the vibrational energy which was given to one permanent magnet as a result in the case of the external force which is an early vibration of a period is boiled for the inertia for the mass which one permanent magnet of further others has, and is not transmitted as kinetic energy

[0012] vibration and the shock which are in agreement in the direction which the rebounding force commits when it has arranged to two permanent magnets which the rebounding force commits like the above -- \*\* -- if the gap of a spatial distance by the rebounding force is generated between the opposite magnetic poles of like-pole nature in big flux density, direct oscillating transfer can be intercepted \*\* An early vibration of a period can be intercepted in two comprehensive operations that energy loss is large and oscillating transfer can be intercepted, because of the hysteresis effect. The surfacing phenomenon of the magnetic-levitation rotation disk 3 on the rotation disk plinth 32 The rotation disk 31 On squares, such as 1-/N of the perimeter of the rotation disk 31 To a radial The lower part magnetic pole of the embedded permanent magnet 41 On squares, such as 1-/N of the perimeter of the rotation disk plinth 32 Since it rises to surface to space after the gravity which the rebounding force in which the upper part magnetic pole of the permanent magnet 42 embedded at the radial opposes mutually, and suits for the said magnetic pole nature generates by the sum total weight of rotation disk 31 weight, camera head 1 weight carried in the rotation disk 31 upper part, and the amount of \*\*\*\*\* adjustment base duplexs has balanced In the static state where a vertical vibration does not occur, supposing the space gap between the rotation disk 31 and the rotation disk plinth 32 has the level rotation disk plinth 32 and the mass center of gravity of the up body with which it equipped on the rotation disk 31 is in the perpendicular medial axis of the rotation disk 31, it will serve as constant value. In such a state Now in the direction of the medial axis 33 of the rotation disk 31 Closed current (it is also called an eddy current) flows in the perpendicular direction of a flat surface with line of magnetic force to the conductor which is in the circumference of the magnetic pole of two permanent magnets, a permanent magnet 41 and a permanent magnet 42, when a dynamic change of the value of a space gap takes place from the rotation disk plinth 32 for vibration given to the perpendicular direction of the rotation disk 31. The operation which vibrational energy is absorbed [ operation ] and attenuates sharply the vibration to the rotation disk 31 from the rotation disk plinth 32 in existence of a space gap occurs. When the perpendicular vibration which has a complicated frequency component as compared with the case where it is coped with as a general cure using a spring object is given, this oscillating serological inhibition reaction reinforces the natural frequency of the specific frequency which is the resonance phenomena by the rotation disk 31, the \*\*\*\*\* adjustment base 2, and the synthetic weight and spring object elastic modulus of a camera head 1, there is also no evil spread in the rotation disk 31, and its oscillating depressor effect is greatest. However, a cure is needed when the medial axis 33 of the rotation disk 31 and the driving shaft of the angle-of-rotation control motor 5 are connected through the vibration isolation form rotation coupler 6 in order to prevent it, since a result which vibration is delivered is brought from this driving shaft if the driving shaft of the angle-of-rotation control motor 5 is directly linked with the medial axis 33 of the rotation disk 31, in order for level rotation of this rotation disk 31 to make vibration of the direction of the level axis of rotation drive by the angle-of-rotation control motor 5.

[0013] The other magnetic pole counters in the direction of the level inside of the permanent magnet 42 embedded by the radial on squares, such as 1-/N of the magnetic pole of the level direction of an outside of a permanent magnet 41, and the perimeter of the rotation disk plinth 32 embedded by the radial on squares, such as 1-/N of the perimeter of the rotation disk 31. And for the said magnetic pole nature, by the rebounding force between two poles, the rotation disk 31 is held in space so that it may be horizontally located at the center of the rotation disk plinth 32. At this time, since it is at the center of the rotation disk plinth 32, the medial axis 33 which has the rotation disk 31 caudad does not touch the rotation disk plinth 32. In the rotation disk plinth 32, the rotation disk 31 is spatially positioned so that it may be located at the center at the horizontal direction of a radial. When horizontal vibration is now given to the horizontal direction of the rotation disk 31 from the rotation disk plinth 32, this vibration is [ in / such a state ] effective in vibration of the direction of the level axis of rotation being absorbed, without being immediately spread on the rotation disk 31 for the inertia by the rotation disk 31, the \*\*\*\*\* adjustment base 2, and the synthetic mass of a camera head 1. The cure which connects the medial axis 33 of the rotation disk 31 and the driving shaft of the angle-of-rotation control motor 5 through the vibration isolation form rotation coupler 6 also by the case of this horizontal propagation of vibration can work effectively, and propagation of the horizontal vibration from [ from the level maintenance gin PAL mechanism 4 ] the lower part can be prevented.

[0014] Next, an operation of remote operation of the direction in the case of operating and observing [ photo and ] a camera and optical instruments is explained. If adjustable remote operation of the \*\*\*\*\* adjustment direction of a camera head 1 equips the \*\*\*\*\* adjustment base 2 with a camera head 1 so that a direction shaft may grow into the attachment bed of the \*\*\*\*\* adjustment base 2 with the \*\*\*\*\* adjustment medial axis of the \*\*\*\*\* adjustment base 2, and a right angle, the attachment bed of the \*\*\*\*\* adjustment base 2 can operate \*\*\*\*\* by remote control with the numerical-control signal from the outside by the \*\*\*\*\* adjustment control motor 21 and reducer style which are built in the \*\*\*\*\* adjustment base 2. Therefore, remote operation of \*\*\*\*\* adjustment of a camera head 1 is attained. The upper part of the magnetic-levitation rotation disk 3 is equipped with adjustable remote operation of the level hand of cut of a camera head 1 so that the perpendicular medial axis of the

\*\*\*\*\* adjustment base 2 furnished with the camera head 1 may correspond with the axis of rotation of the magnetic-levitation rotation disk 3. It has equipped on this ring so that it may be in agreement with the inner ring 4b center of the level maintenance gimbal mechanism 4 in the common perpendicular medial axis of the synthetic construct constituted with the camera head 1, the \*\*\*\*\* adjustment base 2, and the magnetic-levitation rotation disk 3. Furthermore, after equipping the lower part of inner ring 4b of the level maintenance gimbal mechanism 4 with the weight pendant base 7 which equipped the inferior surface of tongue of weight pendant board 7a of the weight pendant base 7 with the weight 8, The vibration isolation form rotation coupler 6 is minded [ of weight pendant board 7a ] for the perpendicular medial axis of the magnetic-levitation rotation disk 3, and the drive axis of rotation of the angle-of-rotation control motor 5. Since it has equipped with the angle-of-rotation control motor 5 so that the medial axis of the magnetic-levitation rotation disk 3 and the drive axis of rotation of the angle-of-rotation control motor 5 may be in agreement after connecting If remote-indication operation rotation of the hand of cut of the angle-of-rotation control motor 5 and the rotation is carried out, the level hand of cut of a camera head 1 can be operated by remote control.

[0015]

[Effect of the Invention] According to this invention On the inner ring of the level maintenance gimbal mechanism which consists of an inner ring pivoted free [ rotation ] focusing on the Y-axis of the outside ring pivoted free [ rotation ] focusing on the X-axis fixed to the case, and the ring outside this, by magnetism Since photography and an observation-airplane machine are laid on a Z direction and the magnetic-levitation rotation disk which is carrying out stable surfacing horizontally, an angle-of-rotation control motor is attached in the shaft under [ this ] a magnetic-levitation rotation disk, a weight is fixed to a soffit and this weight is \*\*\*\*(ed) to the viscous liquid within a case, it has the following effect. For example, by high-speed defense \*\*\*\*\* which navigates on [ the sea ], when carrying out prehension photography of the object of surveillance, in order to obtain an always stable photography image with the television camera with which a hull is large, and rolling, pitching, or the inclination appeared intricately and it was equipped with the direct conventional installation tools during NAV at the line top for the marine wind and the billow, the need that the camera operator is controlling the camera posture continuously is indispensable. In this case, if the candidate for surveillance is caught to a monitoring screen by the surveillance monitor and remote control which were installed in the interior of a ship, this invention can obtain a very stable image and can work safely also at the time of a marine storm. Moreover, although a television camera is carried on the usual universal-head tripod like the former and the direct cameraman is operating manually on the relay move vehicle for broadcast, it is operated on the roof of the relay move vehicle under run, and is a very dangerous situation. In this case, it equips with a camera on the stabilizer by this invention, and installs in the ceiling outside a relay move vehicle, and a surveillance monitor and a remote control are installed in the car, if the work which catches an image is done, a very stable image can be obtained, and it is safe. Moreover, the uninhabited radio control aircraft is equipped with a television camera, radio remote operation of the camera direction is carried out, and stable photography can be performed easily far, without correcting the posture of the aircraft frequently as compared with the case where the shake of the uninhabited radio control aircraft equips the conventional automatic universal head with a television camera as it is intense, and it observes by similarly carrying out radio remote operation, by turbulence generating high up in the sky, if it applies when doing the work which observes the situation of danger zones, such as an active volcano or a lava flow.

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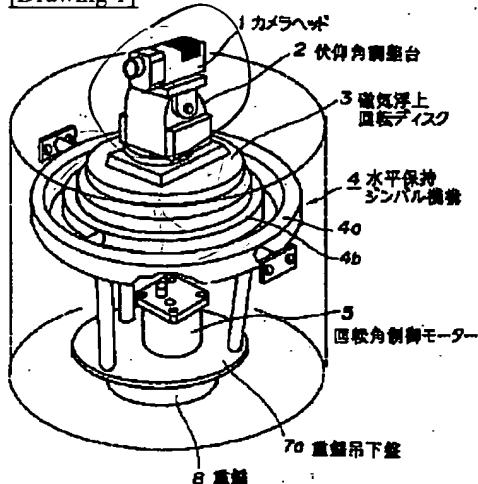
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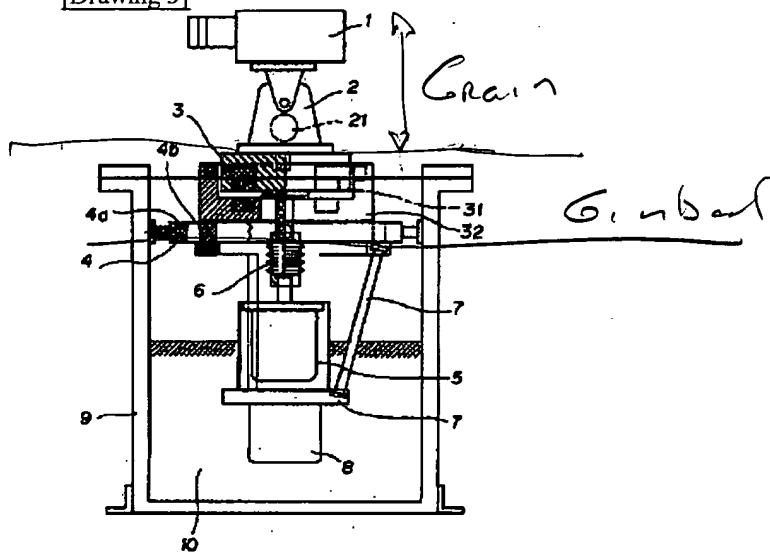
DRAWINGS

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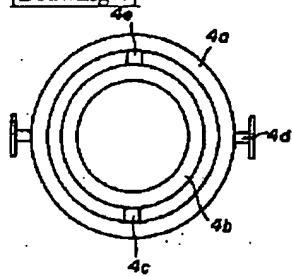
[Drawing 1]

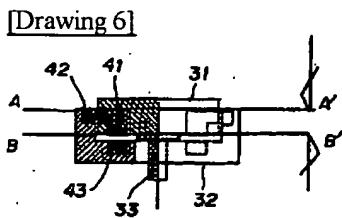
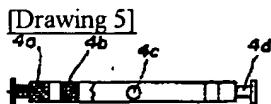


[Drawing 3]

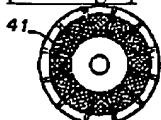


[Drawing 4]

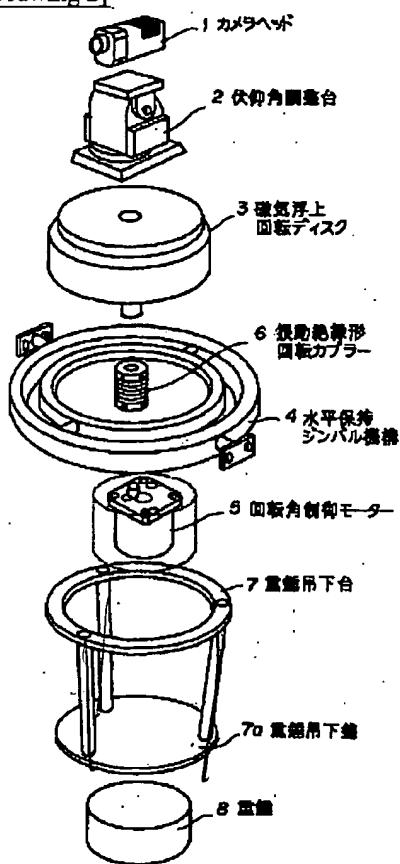




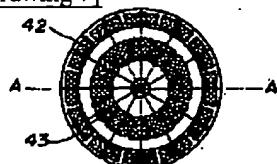
[Drawing 8]



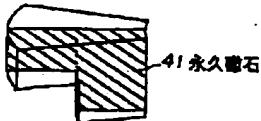
[Drawing 2]



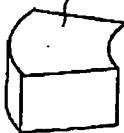
[Drawing 7]



[Drawing 9]



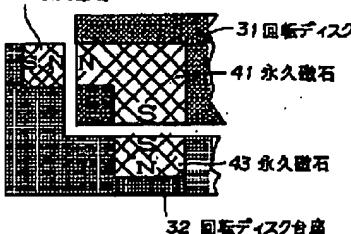
[Drawing 10]  
42 永久磁石



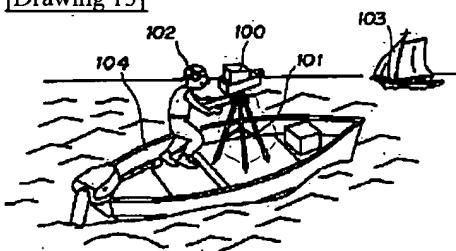
[Drawing 11]



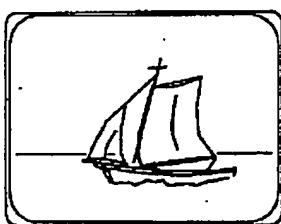
[Drawing 12]  
42 永久磁石



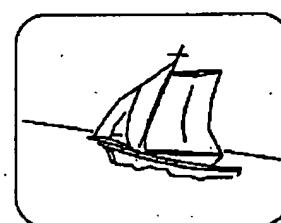
[Drawing 13]



[Drawing 14]  
理想想像

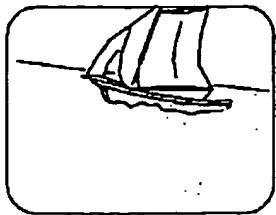


[Drawing 15]  
現実想像



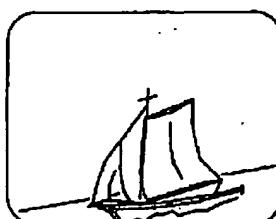
[Drawing 16]

上部カット像



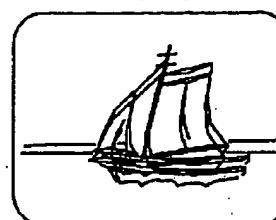
[Drawing 17]

下部カット像



[Drawing 18]

運動ぶれ像



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